Life cycle stages and corporate decisions

Estágios do ciclo de vida e decisões corporativas

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Abstract

Purpose: This article aims to examine the influence of life cycle stages on the corporate decisions of Brazilian firms.

Originality/value: The study contributes by presenting a scenario of investment, financing, dividend, and cash decisions, revealing patterns and characteristics of the evolution of Brazilian firms throughout their life cycle stages. For this, we tested an alternative life cycle proxy capable of classifying firms in different stages, even shake-out and decline, not defined by the model of Dickinson (2011), and applied a more robust methodology (GMM-SYS) considering potential endogeneity problems disregarded by previous studies.

Design/methodology/approach: The sample consists of 203 traded firms listed on B3 from 2010 to 2018. We collected the data from the Thomson Reuters Eikon database. We estimated the parameters of the models by GMM-SYS (Generalized Method of Moments) to mitigate problems of endogeneity, omitted variables, and heterogeneity.

Findings: As our main results, we have that Brazilian firms do not follow a pattern and oscillate between stages and that there is strong evidence of the effect of the life cycle on corporate decisions. In the introduction and growth stages, firms invest more, have more debt, pay fewer dividends, and have greater cash availability. In the mature stage, investments, debts, and the level of cash are lower. In the shake-out stage, no results were significant, requiring further studies to better explore this stage in developing countries, such as Brazil.

Keywords: life cycle, investment decisions, financing decisions, dividend decisions, cash decisions

Resumo

Objetivo: Este artigo tem como objetivo examinar a influência dos estágios do ciclo de vida nas decisões corporativas das empresas brasileiras.

Originalidade/valor: O estudo contribui ao apresentar um cenário das decisões de investimento, financiamento, dividendos e caixa, revelando padrões e características da evolução das empresas brasileiras ao longo dos estágios do ciclo de vida. Para isso, testou-se uma *proxy* alternativa do ciclo de vida capaz de classificar as empresas em diferentes estágios, inclusive turbulência e declínio, não definidos pelo modelo de Dickinson (2011), e aplicou-se uma metodologia mais robusta, levando em conta potenciais problemas de endogeneidade, desconsiderados pelos estudos anteriores.

***Design*/metodologia/abordagem:** A amostra é composta por 203 companhias listadas na B3, no período de 2010 a 2018. Os dados foram obtidos na base de dados Thomson Reuters Eikon. A estimação dos parâmetros dos modelos se deu pelo GMM-SYS (*Generalized Method of Moments*), de modo a atenuar problemas de endogeneidade, variáveis omitidas e heterogeneidade.

Resultados: Os resultados sugerem que as empresas brasileiras não seguem um padrão e ficam oscilando entre os estágios, e que existe uma forte evidência do efeito do ciclo de vida nas decisões corporativas. Na introdução e crescimento, as empresas investem mais, têm mais dívidas, pagam menos dividendos e têm maior disponibilidade de caixa. Já na maturidade, os investimentos, as dívidas e o nível de caixa são menores. Na turbulência, nenhum resultado foi significativo, requerendo estudos adicionais para explorar melhor o estágio em países em desenvolvimento, como o Brasil.

Palavras-chave: ciclo de vida, decisões de investimento, decisões de financiamento, decisões de dividendos, decisões do caixa

INTRODUCTION

In the last 30 years, in an attempt to better understand the consequences of decisions made over time and to try to identify firms' behavior patterns, firms' life cycle has become the focus of several empirical studies, showing its implication on financial reports (Dickinson, 2011; Can, 2020; Novaes & Almeida, 2020; Durana et al., 2021; Krishnan et al., 2021), on governance mechanisms (Kieschnick & Moussawi, 2018; Habib & Hasan, 2018; Naeem & Li, 2019), and on corporate decisions (Drobetz et al., 2015; Faff et al., 2016; Flavin & O'Connor, 2017). These implications stem from the fact that life cycle stages are different phases resulting from changes in internal factors, such as corporate decisions, and external factors, such as the competitive environment and macroeconomic aspects (Dickinson, 2011). This research focuses on those internal factors, considering that organizations develop through them, thus changing their direction and compromising their primary resources.

The life cycle of firms seeks to portray how a firm grows, matures, and declines by analyzing its strategies and structures. Therefore, the organizational life cycle theory went on to be associated with a variety of corporate decisions on such things as dividends, suggesting that mature firms are more profitable and more able to pay out dividends (DeAngelo et al., 2006; Flavin & O'Connor, 2017); financing, suggesting that mature firms have a higher debt capacity since they are older, more profitable, and more cost-effective (Bulan & Yan, 2010; Faff et al., 2016); and investment, suggesting that investment opportunities decrease as firms mature (Faff et al., 2016). Finally, the results are not convergent concerning the life cycle stage in which firms have the most cash available (Drobetz et al., 2015; Faff et al., 2016).

So, there is empirical evidence of the influence of the life cycle stages on corporate decisions (investment, financing, dividends, and cash), with patterns identified over time. However, classifying a firm's current life cycle stage has been one of the main difficulties for scholars since firms are composed of many products, each with a distinct life, and can operate in more than one sector (Dickinson, 2011; Faff et al., 2016).

From this perspective, several studies have sought to create an efficient life cycle proxy (Anthony & Ramesh, 1992; DeAngelo et al., 2006; Bulan & Yan, 2010; Dickinson, 2011). However, such proxies have constraints, either by using univariate measures, making it difficult to classify firms at different life cycle stages, or by using the cash flow signals alone, disregarding the magnitude of their values (Faff et al., 2016; Habib & Hasan, 2018).

This limitation also applies to the evidence pointed out for the Brazilian scenario, given that there are findings in the direction of impact on financing decisions (Reis et al., 2017) and dividends (Galvão et al., 2019), however only considering measurement for life cycle based on a univariate approach or even based on the approach proposed by Dickinson (2011). Moreover, this evidence signals indications of the impact of the life cycle on only two dimensions of corporate decisions, which reflected, therefore, an empirical question of whether the life cycle impacts other corporate decisions, such as investment decisions and cash policy.

The Brazilian scenario provides a peculiar and distinct configuration of the markets in which the evidence for life cycle impact on corporate decisions has been predominant. For example, in Brazil, characteristics such as the existence of mandatory minimum dividend, non-taxation of dividends, and interest on equity (IOE), provided for in Law no. 9.249/95 as an alternative for results payout, may be reflected in relevant events, when considering the interaction between the life cycle and the dividend policy of the firms.

Given this context, we still know very little about the effects of the life cycle on different corporate decisions when considering both the Brazilian scenario and an alternative empirical measure for the life cycle.

That said, this research aims to analyze the influence of the life cycle stages on corporate decisions in an emerging market setting. To this end, we used an alternative life cycle proxy proposed by Faff et al. (2016). This research expands the study of Faff et al. (2016) since, in addition to verifying decisions on investment, financing, and cash, it investigates the dividend policy, which has idiosyncratic characteristics in Brazil.

Moreover, we used the model of Faff et al. (2016) to measure the life cycle stages to improve the model of Dickinson (2011) by using univariate and multilevel variables in a single model. We also used the model of Dickinson (2011) to classify the life cycle stages with two objectives: 1. to pre-classify firms based on their life cycle stages as a prerequisite to use the model of Faff et al. (2016); and 2. to conduct a comparative analysis with the model of Faff et al. (2016).

This study further expands the work of Costa et al. (2017), as it uses an alternative life cycle proxy through the discriminant analysis proposed by Faff et al. (2016), thus eliminating the classification constraints of Dickinson's model (2011). In addition to analyzing the effect that these two measures can produce, the methodology used in this study (Generalized Method of Moments System [GMM-SYS]) is more robust than those used by Faff et al.

(2016), Costa et al. (2017), Reis et al. (2017), and Galvão et al. (2019), as it considers potential endogeneity issues disregarded by those previous studies.

Therefore, this research is important for several reasons: 1. it contributes to the organizational life cycle theory by testing an alternative life cycle proxy capable of classifying firms in different stages, including shake-out and decline, not defined by the model of Dickinson (2011); 2. it collaborates for analysis of corporate decisions over time; and 3. it presents a scenario of decisions on investment, financing, dividends, and cash, analyzed together for the same group of firms in the same time frame, thus revealing patterns and characteristics of the evolution of Brazilian firms.

Finally, the results obtained from this research can inform and make Brazilian investors and analysts aware of the importance of the relationship of corporate decisions with firms' life cycle and provide important data on standardized strategies, thus reducing information asymmetry in an attempt to improve, overall, how those agents analyze firms.

PREVIOUS STUDIES AND RESEARCH HYPOTHESES

The central principle of organizations' life cycle theory lies in the fact that they move through a series of phases (Mosca et al., 2021). Under this premise, organizational life cycle models consider a firm's life to be represented by a sequence of different stages of development (Mosca et al., 2021). Mosca et al. (2021) point out that researchers have been directed to test these models' empirical validity and use them as a theoretical guide to explain administrative practices.

Indeed, firms' life cycle has become the focus of several empirical studies, showing its implication on firms' attributes like stock price (Hasan & Habib, 2017), financial reporting quality (Can, 2020; Durana et al., 2021; Krishnan et al., 2021), governance mechanisms (Kieschnick & Moussawi, 2018; Habib & Hasan, 2018; Naeem & Li, 2019), and organizational design (Mosca et al., 2021), to name a few.

Other studies have signaled life-cycle implications in firm corporate decisions, among which international evidence highlights the impact of this attribute on the firms' three main financial decisions: investment decisions (Ahmed et al., 2020; Arikan & Stulz, 2016; Faff et al., 2016; Habib & Hasan, 2017), financing decisions (Bulan & Yan, 2010; Faff et al., 2016; Kieschnick & Moussawi, 2018) and dividend decisions (DeAngelo et al., 2006; Fama & French, 2001; Flavin & O'Connor, 2017; Grullon et al., 2002). Evidence can

also be highlighted in the direction of the impact of the life cycle of firms on more specific financial decisions, such as those related to cash policies (Drobetz et al., 2015; Faff et al., 2016).

In the Brazilian context, it is possible to point out findings in the direction of the impact of the life cycle on financing decisions (Reis et al., 2017) and dividends (Galvão et al., 2019). On the other hand, this evidence is restricted to using univariate measures for the life cycle and estimators susceptible to endogeneity problems. In addition, there are still few studies aimed at examining the effects of the life cycle on investment decisions and cash policy of firms, which motivates to collect more robust evidence, both according to the measure related to the life cycle and to the econometric method employed, in the direction of the impact of the life cycle on investment, financing and dividends decisions, and cash policy.

The central argument for the development of hypotheses, therefore, lies in the ability of the firm's life cycle to affect financial decisions of investment, financing, dividends, and cash in an emerging market context, as is the case of Brazil. The following are the arguments for each of the hypotheses raised.

Regarding the investment decision, the evidence, in the international context, points out that investments in tangible assets are higher in the early stages of a firm's life cycle (Faff et al., 2016). However, investments in the early and decline phases are riskier; they design a "U" shape and negatively affect a firm's future performance. Similarly, investment in research and development (R&D) is riskier in younger firms when compared to that made by mature firms (Habib & Hasan, 2017).

Analyzing the behavior of corporate acquisitions throughout the life cycle stages in United States' firms, Arikan and Stulz (2016) found that the acquisition rate is higher among young firms. In most cases, those are private-firm acquisitions, which shows that the performance of these acquisitions throughout the life cycle generates value for the acquiring firms. In addition, the literature points out that, in the growth stage, firms' sales evolve more, which suggests that, at this stage, firms make more investments since the amount a firm needs to invest is defined by growth opportunities (Costa et al., 2017).

In the Brazilian context, studies on the possible effects of the life cycle on firms' investment decisions are scarce. On the other hand, the findings of Ahmed et al. (2020) in the context of a developing economy (Pakistan) can be highlighted, which pointed out that investment efficiency varies according to the life cycle of firms. This evidence provides signals that, in

Brazil, also a developing economy, the life cycle probably influences the investments made by firms. So, the first hypothesis of the research arises:

- H1: Firms invest more in their early stages and will invest less as they become mature.

Regarding financing decisions, DeAngelo et al. (2017) emphasize that financial flexibility makes firms avoid permanently high leverage as it would limit their ability to issue debt. This way, a firm's indebtedness can fluctuate according to its life cycle stage. This oscillation was proven by the results of Bulan and Yan (2010) and Faff et al. (2016), as they identified that firms issue more debt as they mature. On the other hand, Kieschnick and Moussawi (2018) observed that the life cycle is negatively correlated with the level of debt, *i.e.*, firms have higher debt only in their early stages.

In Brazil, Reis et al. (2017) analyzed the influence of capital structure determinants on life cycle stages, which was verified by sorting high and low-growth firms; the study indicated that most of the determinants that were used influenced the capital structure at any stage of a firm's life cycle. In addition, the literature suggests a higher indebtedness of firms in their introduction and growth phases (Victor et al., 2018).

Empirical evidence also suggests that financing decisions are related to financial flexibility, so firms choose their financial policies to obtain reliable and economical access to capital, thus deciding between internal or external resources to finance their investments. This said, if the country's economy is based on the market or banks, the relationship of the life cycle with financing decisions may be different (La Rocca et al., 2011). Therefore, the second research hypothesis arises:

- H2: Firms have a higher level of indebtedness in their early stages, which decreases as they pass from the mature stage to the decline stage.

Regarding the dividends decision, one of the first empirical studies to test the life cycle relationship with dividend policies was that of DeAngelo et al. (2006), which related the retained earnings/equity index to the firm's likelihood of paying dividends. Their main results ratified the findings of Fama and French (2001) and Grullon et al. (2002) in that it suggests that younger firms grow more but cannot pay out dividends, while mature firms are more profitable and capable of paying out dividends. Such results were corroborated by Flavin and O'Connor (2017).

In Brazil, Galvão et al. (2019) analyzed the dividend payout policy of Brazilian firms. They observed that older, more mature, more profitable firms with more cash and significant growth opportunities are more likely to

pay dividends. Based on these characteristics, there is strong evidence of the life cycle effect on dividend payout in Brazil.

In addition, Brazil has several factors that differ from the dividend payout policy of other countries, such as a mandatory minimum payout and distinctive taxation, since there is still no taxation on profit payouts. With this particular policy in Brazilian firms, it is interesting to analyze the life cycle stages and the dividend policy since empirical evidence suggests a relationship between dividend payout and life cycle, proposing that the dividend payouts may present a predictable pattern, with greater payout when firms reach maturity; however, it is still not known whether this pattern can be observed in a country with such a peculiar dividend policy, as observed in Brazil. Given the above, the third research hypothesis arises:

- H3: Firms pay more dividends as they mature.

Finally, regarding cash decisions, firms use different strategies for their available cash volume to deal with numerous constraints and challenges that arise throughout the organization's development. Therefore, a firm's life cycle is important for its cash dynamics. In this sense, cash volume varies due to the demand for money throughout the different stages of a firm's life cycle; cash is more significant in the early and post-maturity stages. However, it decreases when firms advance toward maturity (Drobetz et al., 2015). On the other hand, Faff et al. (2016) found increased availability in the introduction and growth phases and a decrease in the post-maturity stages due to the reduction of financing, which contradicts, in part, the findings of Drobetz et al. (2015).

Given the above, there is no consensus in the literature on the relative importance of the interaction between a firm's life cycle and its cash policies, and there are divergent results on the post-maturity phases. Then, according to the literature, younger firms grow more and require greater investments in their early stages, most often through financing, which increases the available cash flow.

However, growth opportunities decrease over the life cycle. In their mature stage, firms reduce investments and seek greater cash flows. In the shake-out/decline phase, firms seek to restructure, reducing investments and selling assets to generate cash. Thus, at this stage, a firm may experience a reduction in cash flow (Miller & Friesen, 1984; Grullon et al., 2002; Chang et al., 2014; Dickinson, 2011; Frezatti et al., 2017).

Although there is no direct evidence for Brazil, Artica et al. (2019) analyzed the increase in cash indices in Latin American firms. They noted a significant increase, suggesting that the main reason was the precaution of

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potential financial constraints. However, this reason does not seem to prevail in Brazil due to the easy access to the development bank credit through the Brazilian National Bank for Economic and Social Development (Banco Nacional de Desenvolvimento Econômico e Social – BNDES). Those authors also observed that bigger firms and those paying dividends maintain lower cash levels. With such a cash increase in Brazilian firms over the years, analyzing the relationship between the life cycle stages and cash is stimulating, considering that this volume may vary due to the demands at each life cycle step. Given the above, the fourth research hypothesis arises:

- H4: Firms have greater cash flows in their introduction and growth phases, which are reduced as they reach their shake-out/decline phase.

METHODOLOGICAL PROCEDURES

Data

The sample comprised all publicly traded firms with shares traded in Brazil, Bolsa e Balcão (B3). The following firms were excluded from the sample: firms in the financial sector since the essence of their cash flows is different from other firms', and they have low investment in physical capital (DeAngelo et al., 2006; Chang et al., 2014; Faff et al., 2016); firms in the public utility sector, because they are under strong government regulation (Faff et al., 2016); and the firms whose information necessary for the survey was not available. Therefore, the sample counted 203 firms.

We obtained the data from the Thomson Reuters Eikon database, year after year, from 2010 to 2018. We chose 2010, the year firms adopted the International Financial Reporting Standards (IFRS), while 2018 was the last with information available during data collection.

Life cycle classification

We used a multiclass linear discriminant analysis proposed by Faff et al. (2016) to classify the firms' life cycle stages. This type of analysis groups together the data with similar characteristics, verifying altogether the information provided by the variables age, retained earnings to total assets, cash flow, and assets growth. As a proxy for the firms' age, we adopted the listing time on B3. However, the firm may have existed long before it was listed on the stock exchange, and, therefore, some adjustments were made. We

regressed age on size due to the bias that larger firms are older and, on the sector, to control the age variation between sectors since each sector has specificities that influence the evolution of firms. We used the residual of said regression as the age variable in the multiclass linear discriminant analysis presented in Equation 1.

After generating the age variable, we ran the discriminant analysis to develop a life cycle proxy in an attempt to fix the constraints presented by some variables used in the literature as a life cycle proxy (Faff et al., 2016). However, to use discriminant analysis, firms need to have been previously sorted into groups. Therefore, we used the classification scheme that Dickinson (2011) proposed based on cash flow patterns to classify firms according to their life cycle stages. This annual classification is based on the signals observed in the cash flow statement. Thus, the firms were sorted into four groups, according to their life cycle stage in a given year, namely: 1. introduction; 2. growth; 3. maturity; and 4. shake-out/decline.

Dickinson's model (2011) has some limitations, such as using only the cash flow signal to classify the life cycle stages and disregarding the magnitude of their values (Faff et al., 2016; Habib & Hasan, 2018). Considering this fact, we used the model of Dickinson (2011) only in the first stage of the classification of firms, complemented by the model of Faff et al. (2016), to develop a more efficient proxy to represent the firms' life cycle.

This considered, the Dickinson (2011) classification scheme fulfills its first objective, which is to pre-classify firms into groups, complemented by the model of Faff et al. (2016), to provide maximal separation between the groups' development and to provide a more efficient proxy to represent firms' life cycle, according to Equation 1.

$$\text{Group}_{i,t} = \beta_0 + \beta_1 \text{Age}_{i,t} + \beta_2 \text{RETA}_{i,t} + \beta_3 \text{EBIT}_{i,t} + \beta_4 \text{Growth}_{i,t} + \varepsilon_{i,t} \quad (1)$$

in which: $\text{Group}_{i,t}$ = the life cycle stage of firm i in time t defined by the classification scheme of Dickinson (2011); $\text{Age}_{i,t}$ = the age of firm i in time t listed on B3, obtained by the regression residual for age, size and sector; $\text{RETA}_{i,t}$ = retained earnings to total assets of firm i in time t; $\text{EBIT}_{i,t}$ = proxy for the operating cash flow of firm i in time t; $\text{Growth}_{i,t}$ = assets growth of firm i in time t; $\varepsilon_{i,t}$ = regression error term of firm i in time t.

Through Equation 1, we ran the multiclass linear discriminant analysis (MLDA), which reclassifies the firms' life cycle stages, and groups together firms that have similar characteristics in an attempt to correct the main constraint of Dickinson's model (2011): using cash flow signals only and disregarding the magnitude of their values. Thus, based on the predicted

classification of model 1, we generated the life cycle stage proxy, which gives rise to four dummies variables defined by the introduction (I), growth (C), maturity (M), and shake-out/decline (T/D) stages; dummy variables take a value of one if a firm is in those stages and zero otherwise, following Faff et al. (2016).

The shake-out and decline stages were made into a single phase due to their similar characteristics (Miller & Friesen, 1984). In these phases, firms need to diversify. Their margins drop, and they can experience losses, while the difference is how intensely these facts occur in each phase.

Econometric model

In order to investigate the impact of the life cycle on corporate policies, a panel data model was estimated using the GMM-SYS, proposed by Arellano and Bover (1995) and Blundell and Bond (1998). To treat endogeneity, we used lagged variables as instruments of the endogenous variables, and to estimate this type of model, the methods called GMM were developed.

Thus, the parameters of Equation 2, used to analyze the impact of the life cycle on corporate decisions, were estimated using the Arellano-Bover and Blundell-Bond model:

$$CD_{i,t} = \beta_0 + \beta_1 CD_{i,t-1} + \beta_2 I_{i,t} + \beta_3 G_{i,t} + \beta_4 S_{i,t} + X_{i,t}\,\beta + \vartheta_{i,t} \qquad (2)$$

in which: $CD_{i,t}$ represents the corporate decisions of investment, financing (debt), dividends, and cash of firm i in time t; $CD_{i,\,t-1}$ is the lagged dependent variable since it is believed that past corporate decisions have a connection with current decisions; variables $I_{i,t}$, $G_{i,t}$ and $S_{i,t}$ are the dummy variables for life cycle stages, introduction, growth and shake-out of firm i in time t, respectively; the mature stage will be analyzed using the constant (β_0); $X_{i,t}$ are the control variables defined for each decision of firm i in time t; and $\vartheta_{i,t}$ is the idiosyncratic error, which admits heteroscedasticity and autocorrelation between observations of the same individual, but not between different individuals.

As a proxy for the investment decision, we used the capital expenditure index for period t divided by the total assets of period t-1 (Faff et al., 2016; Naeem & Li, 2019). For financing decisions, we used the long-term net debt proxy of period t divided by the total assets of period t-1 (Faff et al., 2016). For dividend decisions, we used the interest on-equity ratio plus dividends of period t divided by the equity for period t-1 (Costa et al., 2017). Finally, as a proxy for cash policy, we used the availability index of period t divided by the total assets of period t-1 (Drobetz et al., 2015).

The literature suggests that firms' life cycle stages can interfere with corporate decisions, as firms experience several changes in their internal and/or external factors as they move from one stage to another (Habib & Hasan, 2018). Thus, at the introduction and growth stage, firms show intense growth and high investments and operate at a loss. Consequently, they need to finance their investments with external resources, thus increasing their indebtedness and saving cash, generating increased availability in the introduction and growth phases, which will decrease in the post-maturity phases due to the reduction of financing. Then, they cannot pay out dividends (Anthony & Ramesh, 1992; Bulan & Yan, 2010; Faff et al., 2016; Victor et al., 2018).

In the mature stage, firms' revenues become more stable, with increased cash flows and the possibility of paying dividends; however, investment opportunities decrease, and consequently, so does the need for external financing (DeAngelo et al., 2006; Bulan & Yan, 2010; Faff et al., 2016; Victor et al., 2018).

Firms in the shake-out/decline stage must diversify to deal with more complex and heterogeneous markets. Dickinson (2011) characterizes this phase as the stage of regeneration or survival of the firm when it is necessary to reduce investments and debts and liquidate assets to generate cash.

This considered, the expected relationships between corporate policies (dependent variable) and life cycle stages of organizations (main independent variable) are described in Table 1.

Consistent with Chang et al. (2014), Faff et al. (2016), and Naeem and Li (2019), we also analyzed a set of control variables, for they change over time and influence corporate decisions. The control variables were used separately, according to each dependent variable, since the literature presents different relevant factors for each analyzed corporate policy.

For investment decisions, the following variables were used: size, cash flow, availability, sales growth, growth opportunity, tangibility, and leverage. For financing decisions, the following variables were used: size, cash flow, availability, growth opportunities, working capital, leverage, sales growth, and market-to-book. For dividend decisions, the following variables were used: size, cash flow, availability, leverage, and sales growth. Finally, for cash decisions, the following variables were used: size, cash flow, tangibility, leverage, and sales growth.

Table 1

The expected sign of corporate decisions as a function of the life cycle

Variable	Expected sign				Theoretical basis
	I.	F.	D.	C.	
I (introduction)	+	+	-	+	Anthony and Ramesh (1992), Bulan and Yan (2010), Dickinson (2011), Faff et al. (2016), and Victor et al. (2018).
G (growth)	+	+	-	+	Anthony and Ramesh (1992), DeAngelo et al. (2006), Bulan and Yan (2010), Dickinson (2011), Faff et al. (2016), and Victor et al. (2018).
M (maturity)	-	-	+	-	Anthony and Ramesh (1992), DeAngelo et al. (2006), Bulan and Yan (2010), Dickinson (2011), Faff et al. (2016), and Victor et al. (2018).
S/D (shake-out/decline)	-	-	-	-	Anthony and Ramesh (1992), Dickinson (2011), and Faff et al. (2016).

Note. I. = investment; F. = financing; D. = dividends; and C. = cash.

RESULT ANALYSIS AND DISCUSSION

Exploratory analysis

Table 2 shows the classification of firms using Dickinson (2011) and the change in classification after the linear discriminant analysis. A change in the classification of some firms is noted, especially in the shake-out/decline phase, explained by the fact that the method of Dickinson (2011) does not define the classification for the shake-out and decline phases, and it is done by exclusion. However, by using discriminant analysis, this constraint is countered.

Moreover, the highest frequencies were seen in the growth and mature phases, a result also observed by Costa et al. (2017). In these phases, firms are becoming more efficient and maximizing their profit margins (Drobetz et al., 2015). On the other hand, there were fewer observations in the introduction and shake-out/decline phases (Table 2). According to economic theories, firms classified in the introduction and shake-out phases are more likely to fade out or fail (Faff et al., 2016).

Table 2

Total observations per life cycle stage

	DCS (A)	%	FAFF (B)	%	(B - A)	%
Introduction	166	10.6%	164	10.4%	-2	-1.2%
Growth	386	24.6%	437	27.9%	51	11.7%
Maturity	716	45.7%	780	49.8%	64	8.2%
Shake-out/decline	298	19.0%	185	11.8%	-113	-61.1%
Total	1566	100%	1566	100%		

Empirical evidence from the US market shows that firms classified at a particular stage remain at the same stage the following year since, for a change to occur, firms must renew their strategies; they may even return to previous stages, which is unlikely to happen, though (Faff et al., 2016).

However, according to Table 3, Brazilian firms do not follow a pattern and keep oscillating between stages. With this, firms' classification may change over time due to their characteristics and strategies (Miller & Friesen, 1984). Many firms migrate to the mature stage; of the firms classified as being in their introduction phase in 2017, 50% became mature in 2018. Similarly, of all firms classified as mature in 2017, 71.5% remained so in 2018. This evidence reveals that the Brazilian market is full of firms in their mature stage, a phase in which the firm is consolidated.

Table 3

Changes in life cycle stages between 2017-2018

		Introduction	Growth	Maturity	Shake-out/decline
		2017			
Introduction		25.00%	16.00%	17.24%	13.64%
Growth	2018	25.00%	30.00%	11.21%	18.18%
Maturity		**50.00%**	**54.00%**	**71.55%**	**40.91%**
Shake-out/decline		0.00%	0.00%	0.00%	27.27%
		100.00%	100.00%	100.00%	100.00%

Almost 59% of the firms classified in the shake-out stage are seen to manage to survive and return to their growth and mature stages, where they can be more secure and reduce the risk of bankruptcy. In comparison, 27% continue in their shake-out stage and need to regenerate their strategies to return to the levels of competitiveness.

Curiously, no firm migrated to shake-out from 2017 to 2018. Then, the following question arose: is there a life cycle stage from which more firms migrate to the shake-out stage? So, we ran the same analysis of Table 3 for five years, from 2014 to 2018. On a more extended period, the greatest migration to the shake-out stage is from the introduction stage, which confirms that the introduction and shake-out stages are the ones that pose the biggest risks of not being able to stay in the market.

To exemplify the consistency of the classification following the model of Faff et al. (2016), Table 4 shows the five biggest firms in the sample for each life cycle stage. In the introduction and growth phases, firms are mainly retail, paper and pulp, and food. Although these sectors have their share of the world market, they still see growth as a possibility. In the shake-out and decline stages are firms such as CCX Colombia, which has been in the process of liquidation since 2016 after having signed the *Asset Purchase Agreement* (APA) in 2014 with YCCX Colombia S.A.S., and Hercules, which was hit strongly by Brazil's political-financial crisis of 2014, faces fiscal and operational problems and needs to make adjustments and review procedures to recover its economic activity.

Table 4

The top five firms at each life cycle stage in 2018

Introduction	Growth	Maturity	Shake-out/decline
Embraer	Companhia B. de Distribuição	Petrobras	Minupar Participações
Iochpe Maxion	Suzano Holding	Vale	Nordon Ind. Metalurgicas
Magazine Luiza	Suzano	JBS	CCX Colombia
RaiaDrogasil	Kroton Educacional	Telefônica Brasil	Hercules
Dasa	Marfrig Global Foods	Ambev	Advanced Digital H. M. Preventiva

Having observed this, Table 5 shows the descriptive statistics of corporate decisions by life cycle stage, classified on the discriminant analysis. The investment and cash averages are higher in the early phases and decrease in the mature and shake-out/decline phases. As stated by Alves and Marques

(2007), these are the phases in which firms focus on increasing sales and, therefore, need more cash and more investments since they seek market stability.

Concerning debt, the highest levels of indebtedness are found in the introduction and shake-out stages, which may be one of the reasons firms in these stages have more difficulty continuing in the market. Finally, the most dividend was paid out in the mature phase, when revenues are more stable, investments decrease, and firms manage to pay more dividends.

Table 5

Descriptive statistics per life cycle stage

Dependent variables	Introduction			Growth			Maturity			Shake-out/decline		
	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	N
Investment	**0.056**	0.648	133	**0.068**	0.066	377	0.046	0.039	710	0.034	0.049	129
Debt	**0.371**	0.676	131	0.324	0.453	382	0.225	0.318	678	0.346	0.765	137
Cash	**0.107**	0.145	156	**0.103**	0.114	428	0.085	0.091	767	0.053	0.103	175
Dividends	0.021	0.034	59	0.025	0.037	250	**0.039**	0.046	497	0.016	0.021	47

Econometric model analysis

To analyze the influence of life cycle stages on corporate decisions of investment, financing, dividend, and cash, we used GMM-SYS. The lagged dependent variables (corporate decisions) were transformed into logarithms so that the distribution of these variables was normalized and later treated as endogenous. Besides, the finite sample correction of Windmeijer (2005) was used in the two-step estimation. In order to avoid the issue of excess instruments, the proliferation of instruments was limited, thus creating an instrument for each control variable instead of one instrument for each period and variable. This ensures that information is not lost and produces better results (Roodman, 2006).

First, we analyzed econometric assumptions. The Arellano-Bond test (1991) indicates that the model is correctly specified: residuals have a first-order autocorrelation – AR (1), with no second-order autocorrelation AR (2). This is the expected result since $\Delta\varepsilon_{i,t}$ is correlated with $\Delta\varepsilon_{i,t-1}$, but not with $\Delta\varepsilon_{i,t-2}$ onward. For all the models, the Hansen J test does not reject the null hypothesis, indicating that the overidentification constraints are valid and that the instruments used are exogenous, which ratifies the estimation

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efficacy when using the GMM-SYS. In addition, the number of instruments generated is smaller than the number of groups. The *Difference-in-Hansen* test showed that, in estimating each model, the overidentification constraints are valid for all subgroups. Therefore, the necessary conditions for the model to be accepted as valid were met: 1. the validity of the instruments (Hansen Test), 2. autocorrelation (Arellano-Bond), and 3. the number of instruments smaller than the number of groups.

After validating the model, we analyzed the data; Table 6 shows that the estimates of the coefficients of all the life cycle variables are statistically significant at 1% and 5%, with the expected sign, except for dividend decision, in which the constant, which represents maturity, showed no statistically significant difference, which might be related to the fact that the Brazilian law requires a mandatory minimum dividend.

Table 6

Regression results using the classification of Faff et al. (2016)

Variables	Investment	Debt	Dividends	Cash
DC_{it-1}	0.539***	0.188**	0.427***	0.373***
Introduction	0.218***	0.212**	-0.437**	0.010
Growth	0.188***	0.322***	-0.634***	0.011**
Shake-out	-0.095	-0.094	-0.414	0.005
Size	0.028	0.152***	-0.061*	0.005***
Operating cashflow	2.589***	0.286	2.666***	0.105***
Availability	-0.020	0.591	1.031	
Opportunity	0.079*	-0.181**		
Tangibility	0.456**			-0.023*
Growth	0.584***	0.048	1.770***	0.063***
Leverage	0.018	1.806***	-1.169**	0.002
MB		0.022		
Working capital		0.827**		
Constant	-2.914***	-3.103***	-1.043	-0.089***

(continues)

Table 6 (conclusion)

Regression results using the classification of Faff et al. (2016)

Variables	Investment	Debt	Dividends	Cash
Year	Yes	Yes	Yes	Yes
Observations	990	1038	616	1187
Groups	165	172	121	187
Instruments	31	33	47	47
AR (1) *p*-value	0.000	0.000	0.001	0.010
AR (2) *p*-value	0.247	0.356	0.059	0.153
Hansen J Test *p*-value	0.382	0.111	0.172	0.179
Difference-in-Hansen:				
Excluding Group	0.502	0.081	0.097	0.251
Difference (null H = exogenous)	0.109	0.912	0.711	0.188
Wald Chi-Squared Test	21578.07	2286.11	7062.26	525.92
Wald Test *p*-value	0.000	0.000	0.000	0.000

Note. Statistical significance: 1%***, 5%**, and 10%*.

According to research hypothesis 1, firms invest more in their early stages and will invest less as they become mature. In this sense, we cannot reject hypothesis 1 since, according to the coefficients in the second column of Table 6, investments are higher in the introduction and growth phases and decrease in the mature stage.

This effect is the same found by Drobetz et al. (2015) and Faff et al. (2016) as they analyzed United States' firms and found a negative relationship between the life cycle stages and investment, which suggests that firms in their early and growth phases will invest more to take advantage of growth opportunities, which was confirmed when analyzing the opportunity variable that had a positive relationship with investment, indicating that the greater the investment, the more growth opportunities will arise, while mature firms invest less only to maintain their assets. Another similar observation is with cash flow, which has a positive relationship with investment, suggesting that if investments are higher in the early stages, a firm's operations will also be more significant.

In research hypothesis 2, firms were expected to have more debt in their early stages, decreasing as they moved from the mature stage to the shake-out

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stage. According to Table 6, we also cannot reject hypothesis 2 since the capital structure follows a life cycle pattern, and access to external financing changes as firms go through the life cycle stages, in that such access is greater in the early stages. Similar results were also observed by Faff et al. (2016) and Kieschinick and Moussawi (2018). Victor et al. (2018) did not consider firms' oscillation over the years. However, when analyzing Brazilian firms, those authors also observed that firms were more indebted in their introduction and growth phase.

Still, in line with these results, studies found that the cost of equity capital was higher in the introduction and decline stages and lower in the growth and mature stages, considering that firms face a different level of risk according to their current life cycle stage (Hasan et al., 2015; Novaes & Almeida, 2020) since firms in the introduction phase make high investments, they can operate at a loss, and their fundamentals are more uncertain, due to the low level of disclosure. Due to such a higher cost of capital in the introduction phase, firms can opt for bank financing rather than investing their capital, which raises the level of debt in these phases.

In addition, debt presented a positive relationship with size, which indicates that larger firms have higher debt, and a negative association with opportunity, which suggests that the higher the debt, the more firms will use cash to pay their debts, and this may make it difficult for firms to finance future investments.

These results were also found by La Rocca et al. (2011); as they analyzed Italian firms, they found that firm size and the configurations of the country's economy influenced the way firms financed themselves. They also observed that Italian firms presented higher debts in their early stages since the country's economy still depended greatly on bank financing, a characteristic common to that observed in the Brazilian economy.

According to research hypothesis 3, mature firms were expected to have the most dividend payouts. According to Table 6, the relationship with dividends is negative in the early phases, as expected, because firms in their early phases tend to retain more profit to reinvest since, in these phases, growth is intense. However, making inferences regarding the mature stage was impossible since the relationship was not statistically significant. This result can be explained by the legislation in force in Brazil, where firms must pay out a minimum dividend to protect minor shareholders, preventing major shareholders from retaining all profits and thus promoting the development of the capital market.

The non-significant relationship observed in the mature stage is also based on the dividend smoothing hypothesis since firms can remunerate

their shareholders constantly and sustainably. Moreover, the minimum mandatory dividend payout affects all firms equally, although they have different financial realities. Finally, empirical evidence points to stability in dividend payouts, which indicates that, in addition to the mandatory minimum percentage, managers may fear a greater variation in dividends and thus prefer constant payouts (Vancin & Kirch, 2020).

Table 6 also shows a negative relationship between dividends and leverage, which indicates that when firms are highly leveraged, it is challenging to pay out dividends since cash flow will be compromised.

Regarding research hypothesis 4, firms were expected to show higher cash flows in their introduction and growth phases, which would reduce as the firm reached the shake-out/decline phase. According to Table 6, this hypothesis can also not be rejected, which ratifies the results obtained by Faff et al. (2016). In these phases, firms face high growth, so they can use excess cash flow to reduce debt, thus increasing their ability to realize new investment opportunities (Acharya et al., 2007; Chang et al., 2014), as can be observed in the positive relationship between cash level and firm growth.

In addition, cash can be used in different ways: to pay out dividends, reduce debt, make investments, reduce agency problems, or be held as precautionary savings (Chang et al., 2014; Drobetz et al., 2015). This way, firms use different strategies for the volume of available cash to deal with numerous constraints and challenges that arise throughout the organization's development.

In order to analyze the efficiency of the classification using discriminant analysis, the same models were tested through the life cycle classification proposed by Dickinson (2011), thus fulfilling the second objective of using this classification, which is to compare the results. For the sake of space, the analysis was omitted in this paper, but the results were similar. However, the discriminant analysis model presents a better relationship with the variables of interest, reporting better results and signaling greater efficiency compared to the model of Dickinson (2011).

Another important observation concerns the shake-out stage, which showed no significance in any of the models, a result opposite to that found by Faff et al. (2016), which managed to analyze the decisions in the shake-out stage in the US market. Our results may have been so due to the instability of the Brazilian market, which suffers from strong influences of the outside, of the government, the media, inflation, as well as concentration of high trading volumes in a few firms, which calls for additional studies to better explore the shake-out stage in developing countries, such as Brazil.

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FINAL REMARKS

This article aimed to analyze the influence of the life cycle stages on decisions as to corporate investment, financing, dividend, and cash. To this end, we used the methodology proposed by Faff et al. (2016), which included a multiclass linear discriminant analysis to classify the life cycle stages, and Dickinson's model (2011) for comparison purposes.

Overall, the results show there is strong evidence of the life cycle effect on corporate decisions. According to the results, there was enough evidence not to reject research hypothesis 1, that firms invest more in their early stages and will invest less as they mature. When analyzing the life cycle stages and financing, the evidence points out that we cannot reject research hypothesis 2, that firms issue more debt in their early stages, which decreases as they shift from the mature stage to decline.

According to research hypothesis 3, mature firms were expected to have the most dividend payouts. However, the relationship observed was not statistically significant, which provides evidence for rejecting this hypothesis. This result can be explained by the legislation in force in Brazil, where firms are required to pay out a minimum dividend. Firms choose a smoothing and stability policy to pay out dividends, which indicates that, in addition to the mandatory minimum percentage, managers may fear a greater variation in dividends and thus prefer constant payouts.

As for the results found concerning the analysis of cash availability and the life cycle stages, there is evidence not to reject research hypothesis 4, that firms have greater cash flows in their introduction and growth phases, which is reduced as firms get to the shake-out/decline phase.

Given the above, in their introduction and growth phases, firms invest more, have more debt, pay out fewer dividends, and have more cash available. In the mature phase, though, analyzed through the constant, investments and debts are lower, and the cash level is the lowest of all phases. As for the shake-out phase, no results were statistically significant, and additional studies are necessary to explore it better in developing countries, such as Brazil.

Therefore, the results obtained in this article contribute to the literature by confirming evidence of the relationship between the life cycle theory and corporate decisions of Brazilian firms; to measure the life cycle stages, we used an alternative proxy, one never before analyzed in Brazilian studies, which was able to classify firms in different stages better than the model of Dickinson (2011) and collaborates for analysis of corporate decisions over

time. In addition, a decisions scenario was observed, which revealed patterns and characteristics of the evolution of Brazilian firms, especially regarding dividends, for presenting an idiosyncratic treatment and being relevant for firm evaluation.

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